

# Intravesical botulinum toxin: Practice patterns from a survey of Canadian urologists

James Ross<sup>1</sup>, Duane Hickling<sup>1,2</sup>, Conrad Maciejewski<sup>1</sup>, Rhea Coriaty<sup>1</sup>, Humberto Vigil<sup>1</sup>

<sup>1</sup>Division of Urology, Department of Surgery, University of Ottawa, Ottawa, ON, Canada; <sup>2</sup>The Ottawa Hospital Research Institute, Ottawa, ON, Canada

**Cite as:** Ross J, Hickling D, Maciejewski C, et al. Intravesical botulinum toxin: Practice patterns from a survey of Canadian urologists. *Can Urol Assoc J* 2023;17(1):E15-22. <http://dx.doi.org/10.5489/cuaj.7886>

Published online August 30, 2022

## Abstract

**Introduction:** The objectives of this study were to conduct a survey of intravesical botulinum toxin administration practices in Canada, to compare practices based on level of training, and to identify barriers to delivery.

**Methods:** A voluntary online survey was sent to all members of the Canadian Urological Association. Respondents who provide intravesical botulinum toxin were questioned on training, surgical volume, workup, technique, and followup practices. Those with formal training in functional urology were compared to those without. Barriers to treatment delivery were identified.

**Results:** The overall response rate was 26% (148/570). Most providers (59%) perform 1–10 treatments/month. Preoperatively, 51% perform cystoscopy and 43% perform urodynamics. A majority (66%) give routine antimicrobial prophylaxis; however, regimen and duration varied. Most (79%) perform some treatments under local anesthetic, and 66% instill lidocaine solution for analgesia. There was a wide variation in technique with regards to the number of injections administered (range <10 to >20), volume administered per injection (range 0.5–2 mL), location of injections (bladder body vs. trigone vs. both), and depth of injection. Postoperative followup ranged from three days to three months. Respondents with fellowship training in functional/reconstructive urology performed more treatments per month and administered fewer injections per treatment. Common barriers to delivery included lack of experience/training among non-providers (45%), lack of resources (34%), and lack of medication funding (32%).

**Conclusions:** Despite intravesical botulinum toxin being a widely accepted treatment, significant variability in practices and several barriers to delivery exist in Canada. Further study is required to optimize treatment access and quality.

## Introduction

Intravesical botulinum toxin (BoNT) is a safe and effective treatment option for patients suffering from idiopathic over-

## KEY MESSAGES

- No formal guidelines exist on intravesical botulinum toxin evaluation, administration, or followup, and as such, there is a wide range of practice patterns among Canadian urologists.
- Further research is required to identify appropriate, evidence-based practices for patients undergoing intravesical botulinum toxin injections.
- Several barriers to administration of intravesical botulinum toxin exist among providers and non-providers within the Canadian healthcare system.

active bladder (OAB) and neurogenic lower urinary tract dysfunction (NLUTD) refractory to conservative measures and oral pharmacotherapy. Intravesical BoNT studies have consistently demonstrated a significant improvement in urinary symptoms, urodynamic parameters, and quality of life. As a result, intravesical BoNT has gained widespread acceptance and use among urologists.<sup>1-7</sup>

Although no formal standard of practice guidelines exists, initial clinical trials advocated for the use of higher doses (200–300 units vs. 100–200 units) and more injections per treatment (30 injections of 1 mL aliquots vs. 20 injections of 0.5 mL aliquots) in neurogenic vs. idiopathic OAB.<sup>5-8</sup> Aside from these general recommendations, there is limited data on best practices and no formal national or international guidelines for the administration of intravesical BoNT with regards to preprocedural, periprocedural, and postprocedural practices. In addition, barriers to administration within the universal Canadian healthcare system have not been extensively explored in intravesical BoNT providers and non-providers and may be further impacted by provincial variability in resources and medication funding.

The primary objective of this study was to characterize the intravesical BoNT practice patterns of Canadian urologists via a comprehensive online survey. We hypothesized that Canadian urologists would vary widely with regards to evaluation, administration, and followup. Secondary objectives were to identify barriers to intravesical BoNT adminis-

tration within the Canadian healthcare system, as well as to assess for differences in practice patterns between providers with formal fellowship training in functional urology and those without.

Methods

An anonymous, web-based, bilingual survey was administered to all practicing Canadian urologists who are members of the Canadian Urological Association (CUA) through the internal membership directory. Separate approval to access the directory was obtained from the CUA. The survey was distributed using the LimeSurvey platform ([www.limesurvey.org](http://www.limesurvey.org)). Urology residents, fellows, or Canadian urologists who do not practice in Canada were excluded. The survey was created and reviewed by three staff urologists at The Ottawa Hospital with formal fellowship training in functional/reconstructive urology who regularly perform intravesical BoNT (HV, DH, CM), as well as one urology fellow in functional and reconstructive urology at the same institution (JR). No formal pilot testing was performed. Approval from our institutional research ethics board was obtained.

For urologists who do not perform intravesical BoNT, the survey was divided into two main segments: 1) basic demographic and practice information (highest level of training, location and type of practice); and 2) barriers to providing intravesical BoNT. For urologists who perform intravesical BoNT, the survey was divided into five main segments: 1) demographic and practice information (highest level of training, location and type of practice); 2) preprocedural practices

(investigations and antimicrobial prophylaxis); 3) intra-procedural practices (analgesia, number, volume, and site of injections); 4) postprocedural practices (followup interval and testing); and 5) barriers to providing intravesical BoNT. The impact of the COVID-19 pandemic on the administration of intravesical BoNT was also assessed.

All data was collected and stored on the secure LimeSurvey server. The proportion of respondents for each answer was calculated. Respondents who reported specific training in functional urology were identified and practice patterns were compared to those without specific training using the Chi-squared test for nominal and Mann-Whitney U test for ordinal variables. All statistical analysis was performed using SAS software version 9.4.

Results

The survey was administered to 570 Canadian urologists; 148 urologists completed the survey, for an overall response rate of 26%. Of the respondents, 119 (80.4%) perform intravesical BoNT and 29 (19.6%) do not.

Providers of intravesical BoNT (n=119)

Demographics

Most respondents completed a urology residency only (38.7%), were from Central Canada (including Ontario and Quebec, 52.9%), and described having a general community practice (49.6%) (Figure 1). Most providers (58.8%) perform 1–10 intravesical BoNT treatments per month; 9.2% perform

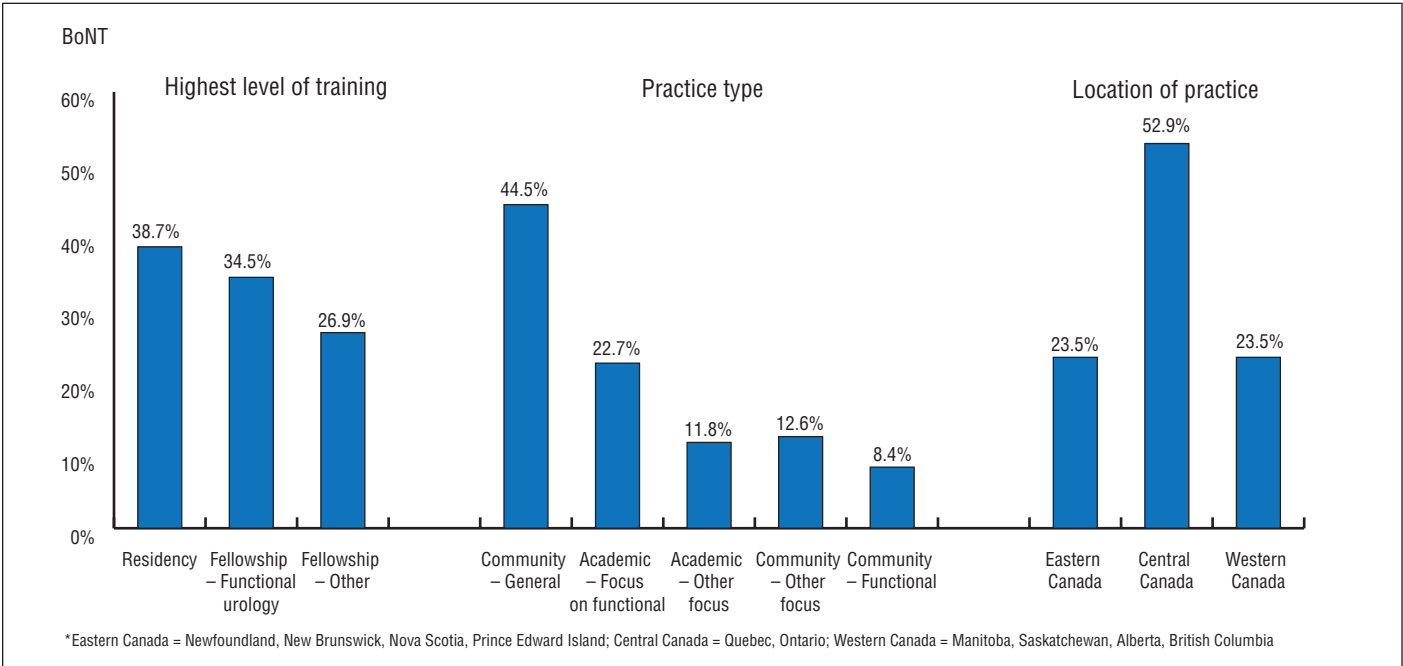
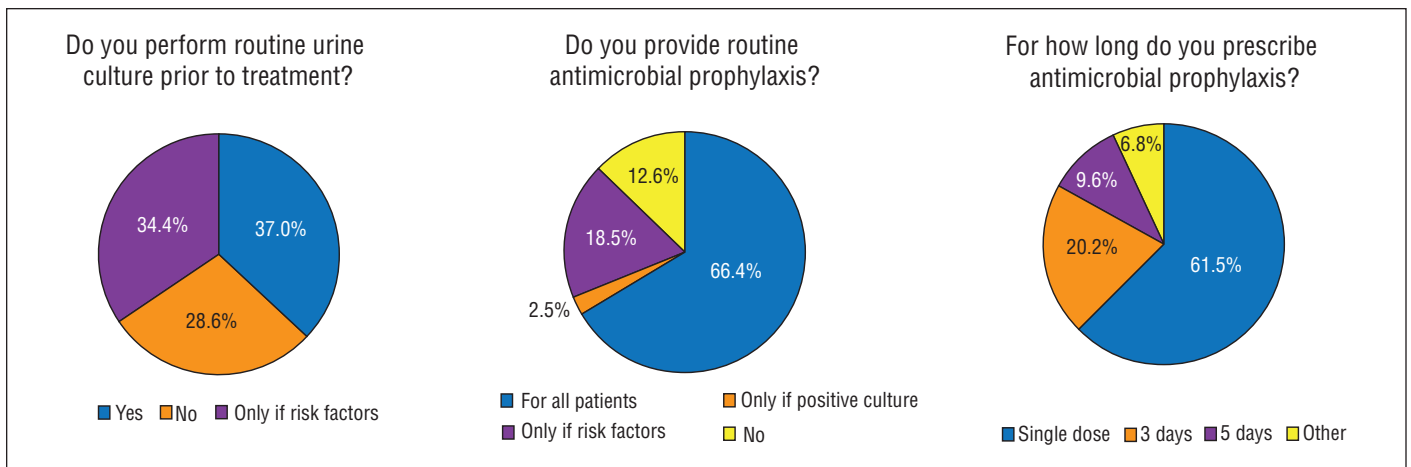


Figure 1. Demographics and practice information for respondents who provide intravesical botulinum toxin (BoNT).



**Figure 2.** Infection prophylaxis patterns for respondents who provide intravesical botulinum toxin (BoNT).

10–20 treatments per month; 7.6% perform greater than 20 treatments per month; and 24.4% perform less than one treatment per month.

### Funding

Most (49.6%) reported that intravesical BoNT is fully covered with prespecified conditions by the province in which they practice (i.e., patient must be a certain age, have a specific diagnosis, or have failed other treatments); full coverage without conditions was reported by 33.6%, partial coverage with or without conditions by 11.8%, and private payer only by 5.0%.

### Preprocedural assessment

Postvoid residual (PVR) measurement was most commonly performed prior to treatment (61.0%). Other preprocedure testing frequently performed included cystoscopy (51.3%), multichannel urodynamics (42.9%), non-invasive uroflowmetry (38.7%), and ultrasound (10.9%). Fourteen percent do not routinely perform any investigations prior to treatment. The majority (67.2%) do not perform routine clean intermittent catheterization (CIC) teaching, whereas 29.4% perform CIC teaching for patients with an anticipated increased risk of retention, and 2.5% perform CIC teaching for all patients.

### Infection prophylaxis

Thirty-seven percent of respondents perform preprocedural urine cultures in all patients and 66.4% give routine antimicrobial prophylaxis. For those who provide routine prophylaxis, 61.4% use a single dose at the time of BoNT (Figure 2). The most common antimicrobial used for prophylaxis is cefalexin/cefazolin (39.7%), followed by ciprofloxacin (26.5%), and nitrofurantoin (10.3%).

### Analgesia

A majority (62.2%) perform  $\geq 75\%$  of BoNT treatments under local cystoscopy compared to 24% who perform all treat-

ments in the operating room under sedation/general anesthetic. For those performing treatments under local cystoscopy, most (66%) use instillation of a lidocaine solution for analgesia (Table 1).

### Technique

Most perform 10–15 injections per treatment (44.5%) and over half (61.2%) administer 1 mL of BoNT solution per injection. Almost three-quarters (74.0%) administer injections into the bladder body only (trigone-sparing) and 84.0% perform intradetrusor injections (Figure 3).

### Followup

For the first followup visit, 34.4% of respondents will see patients back at six weeks compared to 28.5% who see patients back at four weeks and 19.5% who see them back

**Table 1. Percentage of procedures performed under local anesthetic and type of analgesia used for providers of intravesical BoNT treatment**

Variable	Outcome
Percent of treatments performed under local cystoscopy	
0%	21.0%
1% to <25%	5.04%
25% to <50%	2.5%
50% to <75%	8.4%
75% to <100%	27.7%
100%	34.5%
Type of local analgesic used	
None	3.0%
Intravesical lidocaine gel	30.0%
Intravesical lidocaine solution	52.0%
Other	15.0%
Intravesical lidocaine solution	
Median dwell time, minutes (IQR)	30 minutes (10 minutes)
Concentration, % (range)	2% (1–4)
Volume, mL (IQR)	40 mL (32.5)

IQR: interquartile range

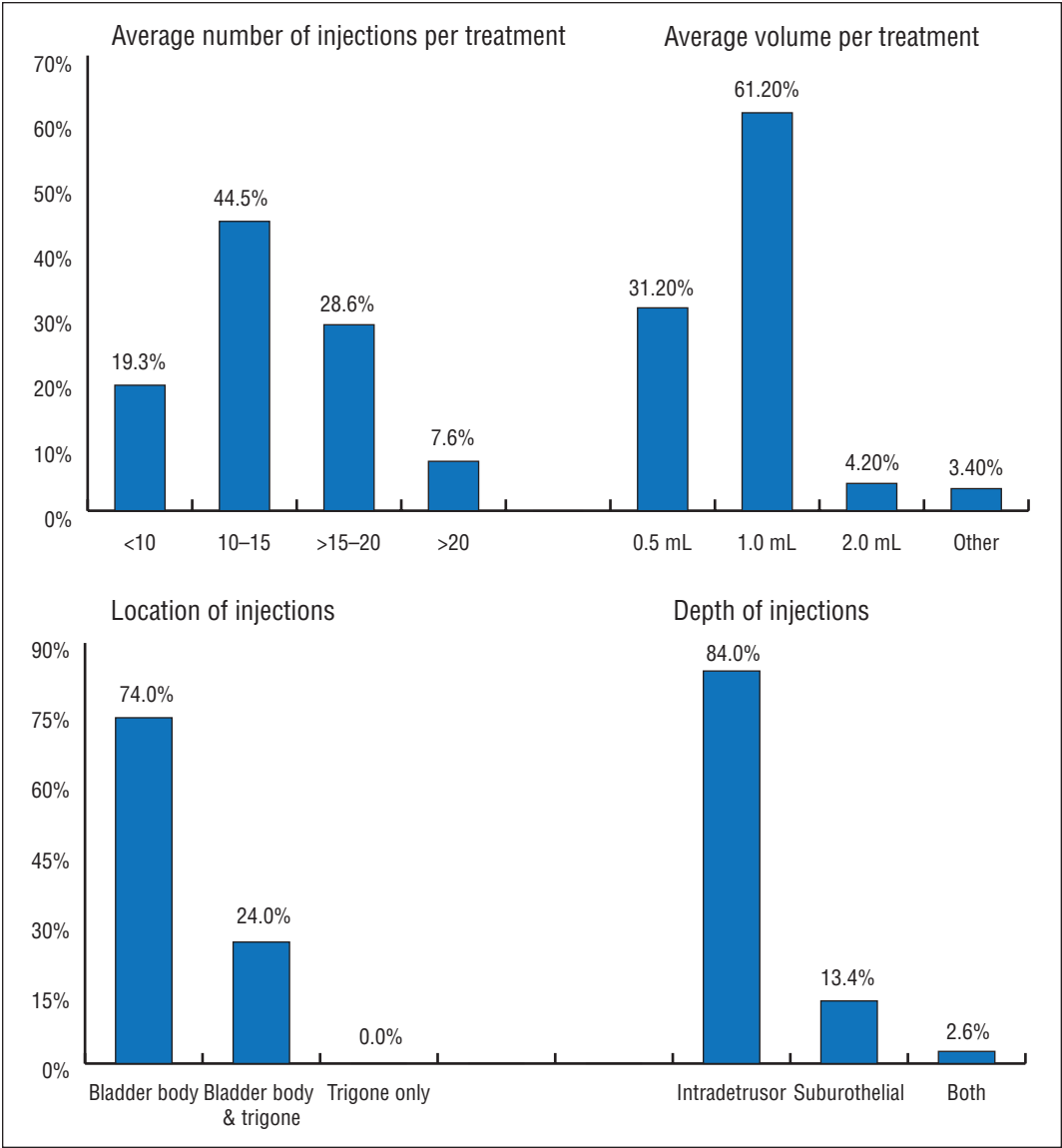


Figure 3. Techniques for administration of intravesical botulinum toxin (BoNT).

at two weeks. The remainder (17.6%) see patients back at intervals ranging between three days to three months. As part of the followup visit, 33.6% of respondents will always perform a PVR measurement, 14.3% perform PVRs only after the first treatment, 38.7% only if the patient reports voiding difficulties, and 13.4% do not routinely measure PVRs at followup.

Barriers to treatment for providers (n=119) and non-providers (n=29)

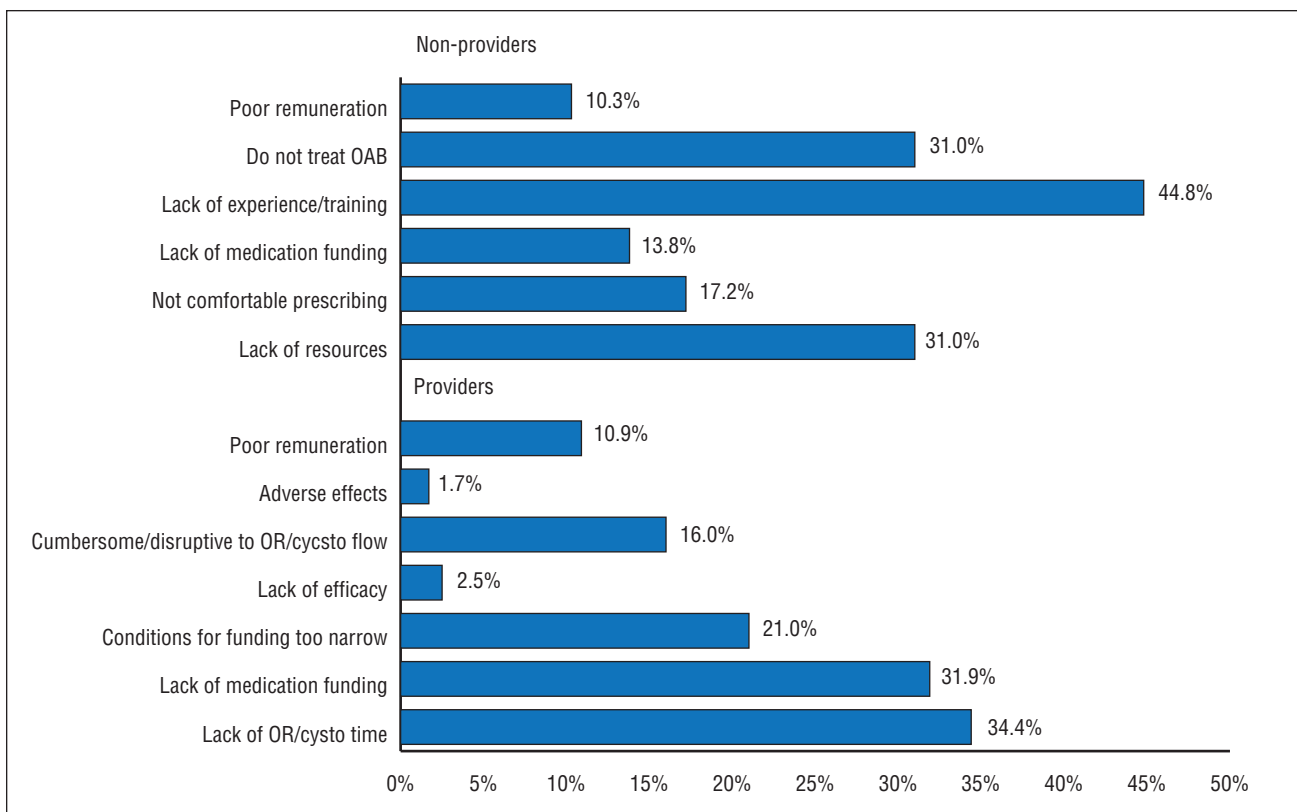
For respondents who are providers of intravesical BoNT, the most commonly identified barrier to administration was a lack of operating room/cystoscopy time (34.4%). A lack of funding for BoNT was identified as a barrier by 31.9% of providers (Figure 4). For respondents who do not perform

intravesical BoNT, the most common reason for not providing treatment was little to no experience or training with intravesical BoNT injections (44.8%), followed by limited resources (31.0%) (Figure 4).

The COVID-19 pandemic was identified as a cause of increased wait times for treatment by 67.2% of providers, had resulted in a temporary cessation of treatment by 26.0%, and 26.0% reported no significant impact on their practice.

Impact of formal fellowship training

Respondents who have had formal fellowship training in functional urology performed more intravesical BoNT treatments per month and administered fewer injections per treatment compared to respondents without formal fellowship training



**Figure 4.** Barriers to administration of treatment for both providers and non-providers of intravesical botulinum toxin (BoTA). OAB: overactive bladder; OR: operating room.

in functional urology ( $p < 0.05$ ). There were no other differences in practice patterns based on level of training (Table 2).

## Discussion

To our knowledge, this study is the first to characterize both practice patterns, as well as barriers to delivery for intravesical BoNT within the Canadian healthcare system. As hypothesized, there was a wide range of practices noted among providers of intravesical BoNT. Specifically, within the Canadian healthcare system, provincial differences in healthcare resources and funding may be contributing to some of the variability in practices (i.e., medication subsidy and access to treatment); however, further study would be required to confirm this. Of note, a majority of respondents who provide BoNT are community urologists with no formal fellowship training in functional urology.

There are no definitive guidelines on preprocedural investigations to be completed prior to intravesical BoNT injections. The results of this survey indicate that urologists most commonly perform a measurement of PVR before BoNT administration (61.3%); this is likely because of the risk of urinary retention that has been found to occur in 5–41% of patients, in a dose-dependent manner.<sup>3,9</sup> Cystoscopy (51.3%) and urodynamics (42.9%) were also commonly performed.

Although no formal recommendations on the use of urodynamics exist, initial clinical trials evaluating BoNT for idiopathic OAB did not routinely use pretreatment urodynamics for patient selection.<sup>4,6,10</sup> Furthermore, recent cohort studies have not demonstrated differences in outcomes for patients with and without detrusor overactivity on pretreatment urodynamics.<sup>11–13</sup> Given these findings, in the absence of clinical concern for NLUTD or impaired capacity/compliance, consideration towards patient-reported outcomes of intravesical BoNT may be both an effective and practical means of monitoring treatment response. Urodynamics may be employed in patients with NLUTD, suspected bladder outlet obstruction, mixed incontinence, or with risk factors for impaired compliance.

There is a lack of specific antimicrobial prophylaxis recommendations for intravesical BoNT injections.<sup>14</sup> A recent American Urological Association best practice statement recommends a single dose of prophylaxis for any procedure with potential violation of the genitourinary tract but offers no procedure-specific guidance.<sup>15</sup> Although most respondents in our survey (66.4%) provide routine antimicrobial prophylaxis, antibiotic regimens and durations vary widely. A recent review on duration of prophylaxis noted a significant decrease in infection with three days of a fluoroquinolone compared to a single dose of ceftriaxone (20.8% vs. 36%,



**Table 2. Comparison of practice patterns between respondents with formal fellowship training in functional and reconstructive urology compared to those without**

Variable	Fellowship-trained in functional urology (n=41)	Non-fellowship-trained in functional urology (n=78)	p
Frequency of treatment			
< 1/month	4 (9.8)	29 (37.3)	<0.0001
1 to <10/month	20 (48.8)	45 (58.2)	
10 to <20/month	9 (22.0)	3 (3.0)	
≥0/month	8 (19.5)	1 (1.5)	
% of treatments under local cysto			
0%	4 (9.8)	27 (34.2)	0.1195
>0% to <25%	1 (2.4)	6 (7.5)	
25% to <50%	3 (7.3)	0 (0.0)	
50% to <75%	5 (12.2)	6 (7.5)	
75% to <100%	18 (43.9)	17 (22.4)	
100%	10 (24.4)	22 (28.4)	
Anesthetic type			
Lidocaine solution	30 (73.2)	53 (68.2)	0.8508
Lidocaine gel	9 (22.0)	22 (27.3)	
Nothing	2 (4.9)	3 (4.6)	
Preprocedural investigations			
Uroflow	18 (43.9)	33 (41.8)	0.8295
PVR	26 (63.4)	55 (70.2)	0.4680
Urodynamics	24 (58.5)	31 (40.3)	0.0654
Ultrasound	4 (9.8)	10 (13.4)	0.5688
Cystoscopy	40 (51.2)	47 (59.7)	0.3882
None	2 (4.9)	5 (6.0)	0.8100
Number of injections			
<10	7 (17.1)	0 (0.0)	<0.0001
10 to <15	26 (63.4)	28 (35.8)	
15 to <20	7 (17.1)	41 (52.2)	
≥20	1 (2.4)	9 (11.9)	
Distribution of injections			
Bladder body	29 (70.7)	56 (71.6)	0.9192
Bladder body and trigone	12 (29.3)	22 (28.4)	
Depth of injections			
Intradetrusor	36 (87.8)	63 (80.6)	0.3294
Suburothelial	5 (12.2)	15 (19.4)	

PVR: postvoid residual.

p=0.04).<sup>16</sup> Another study found no difference in infection when comparing antimicrobial type or route of administration.<sup>14</sup> Further study is required to champion antimicrobial stewardship and identify the optimal regimen and duration of prophylaxis for intravesical BoNT.

Only 34.4% of respondent providers perform routine preprocedural urine cultures. The most recent guidelines from the Infectious Diseases Society of America recommend the screening and treatment of asymptomatic bacteriuria for procedures with anticipated mucosal trauma.<sup>17</sup> A recent retrospective review demonstrated that patients with asymptomatic bacteriuria have an increased risk of urinary

tract infection (odds ratio 16.48) but not urosepsis or hospitalization.<sup>18</sup> The overall risk of infection must be balanced against the recognized risk of antimicrobial overuse and the emergence of bacterial resistance. The routine identification of asymptomatic bacteriuria prior to intravesical BoNT may reduce antimicrobial exposure and procedure-related morbidity; however, further study is required.

The optimal analgesic for patients undergoing intravesical BoNT injections is also not well defined. Initial studies have used a wide array of analgesia, ranging from no specific anesthesia to general anesthesia.<sup>7,19,20</sup> A prior survey of functional and reconstructive urology experts revealed that preprocedural instillation of intravesical lidocaine solution was the most common regimen used by respondents.<sup>21</sup> Intravesical instillation of lidocaine solution requires additional time and personnel resources, as well as an additional catheterization for patients. Interestingly, a randomized controlled trial found that alkalinized lidocaine solution was not superior to lidocaine gel for pain control during intravesical BoNT injections.<sup>22</sup> Therefore, further study on the most effective and efficient means of analgesia in these patients is warranted.

A wide range of injection-specific patterns were noted, with respondents differing in the number, volume, location, and depth of injections. Most studies have used injection volumes of 0.5–1.0 mL distributed into the detrusor muscle over 20–30 injections.<sup>21</sup> A previous study using gadolinium-tagged BoNT found no difference in the distribution of injected BoNT when comparing 10 injections to 30.<sup>23</sup> In terms of depth of injection, previous randomized studies have demonstrated similar efficacy between suburothelial and intradetrusor injections.<sup>13</sup> Previously, injections into the trigone have been avoided due to the theoretical risk of inducing vesicoureteric reflux; however, several studies have disproven this concern.<sup>13,24</sup> Whether inclusion of the trigone into injection protocols provides any additional advantage is a matter of debate, with some studies demonstrating a benefit to trigonal inclusion and others showing no difference in efficacy.<sup>25–27</sup>

The optimal time frame for followup post-BoNT injection is also poorly defined. Based on initial trials, two-week followup was initially recommended and differs from the results of our survey. Most respondents arrange followup in the 4–6-week range, with some waiting up to three months.<sup>21</sup> The majority of respondents will perform a PVR measurement following treatment, either for all patients or just after the patient's first treatment; however, the role of routine PVR assessment in the absence of voiding symptoms has not been evaluated. Only a small portion of respondents routinely perform CIC teaching for patients undergoing intravesical BoNT. The incidence of CIC after intravesical BoNT ranges widely, from 5–41%, with no specific recommendations on the need for routine teaching.<sup>13</sup>

Unsurprisingly, respondents with formal training in functional urology provide more intravesical BoNT treatments per month compared to those without formal fellowship training in the field. Interestingly, providers with fellowship training perform less injections per treatment. The reason for this is not fully apparent but may be reflective of the non-significant trend towards providing more treatments under local cystoscopy (minimizing patient discomfort) or the failure to show a definite difference in BoNT efficacy by injection number.<sup>28</sup>

A number of potential barriers to treatment delivery were identified. Predictably, operating room and cystoscopy resources were found to be the most limiting for BoNT providers. Although BoNT can be safely and effectively performed under local anesthetic, administration and anesthetic techniques may be unfamiliar to providers and further limit its delivery. Additionally, nearly half of non-providers expressed a lack of comfort with prescribing and administering BoNT treatment. Facilitating local cystoscopy intravesical BoNT administration through evidence-based recommendations, workshops, or comprehensive online videos has the potential to improve both patient and provider experience, resource utilization, and BoNT access. Finally, provincial BoNT funding needs to align with guideline recommendations for refractory OAB and NLUTD patients, as it was identified as a barrier to delivery by 31.9% of providers and 21.0% of non-providers. Therefore, by improving and standardizing provincial funding of intravesical BoNT, we likely improve universal healthcare equity and accessibility.

## Limitations

A limitation of this study includes its survey-based design. It is possible that respondents may not have accurately reported answers to the survey; however, we anticipate this risk to be minimal given its anonymous nature. Furthermore, the survey was voluntary and not all urologists were captured, especially non-members of the CUA. Nonetheless, the response rate was over 25% (more than one in four practicing CUA members), and therefore, we feel that the results reflect practice patterns across Canada. This survey was also not distributed to Canadian urogynecologists, who perform a significant portion of intravesical BoNT injections in women. Only 19.6% of respondents do not provide BoNT, which likely represents a selection bias towards providers of BoNT. The main purpose of distributing the survey to non-providers was to identify barriers to treatment delivery within this cohort.

## Conclusions

Intravesical BoNT is a widely accepted and administered treatment for patients with refractory OAB and NLUTD. Due

to an overall lack of high-quality evidence for proper assessment and administration, there remains a wide variation in practice patterns among Canadian urologists. There is an urgent need for further study to optimize efficacy, efficiency, and safety of treatment. The results of our survey can be used as a guide by which further study can be established. In addition to a paucity of available evidence, formal guidelines or best practice statements are required to standardize assessment, administration, and followup among BoNT providers. Furthermore, addressing identified barriers to treatment delivery, either through local or national initiatives, may help to improve quality and access to care for patients with OAB and NLUTD in Canada.

**Competing interests:** Dr. Ross has attended advisory board meetings for and received honoraria from AbbVie. Dr. Maciejewski has received speaker honoraria from Astellas. The remaining authors do not report any competing personal or financial interests related to this work.

This paper has been peer-reviewed.

## References

1. Ehren I, Volz D, Farrelly E, et al. Efficacy and impact of botulinum toxin A on quality of life in patients with neurogenic detrusor overactivity. *Scand J Urol Nephrol* 2007;41:335-40. <https://doi.org/10.1080/00365590601068835>
2. Duthie JB, Vincent M, Herbison GP, et al. Botulinum toxin injections for adults with overactive bladder syndrome. *Cochrane Database Syst Rev* 2011:CD005493. <https://doi.org/10.1002/14651858.CD005493.pub3>
3. Anger JT, Weinberg A, Suttrop MJ, et al. Outcomes of intravesical botulinum toxin for idiopathic overactive bladder symptoms: A systematic review of the literature. *J Urol* 2010;183:2258-64. <https://doi.org/10.1016/j.juro.2010.02.009>
4. Dmochowski R, Chapple C, Nitti VW, et al. Efficacy and safety of onabotulinumtoxinA for idiopathic overactive bladder: A double-blind, placebo-controlled, randomized, dose-ranging trial. *J Urol* 2010;184:2416-22. <https://doi.org/10.1016/j.juro.2010.08.021>
5. Ginsberg D, Gousse A, Keppenne V, et al. Phase 3 efficacy and tolerability study of onabotulinumtoxinA for urinary incontinence from neurogenic detrusor overactivity. *J Urol* 2012;187:2131-9. <https://doi.org/10.1016/j.juro.2012.01.125>
6. Chapple C, Sievert KD, MacDiarmid S, et al. OnabotulinumtoxinA 100 U significantly improves all idiopathic overactive bladder symptoms and quality of life in patients with overactive bladder and urinary incontinence: a randomised, double-blind, placebo-controlled trial. *Eur Urol* 2013;64:249-56. <https://doi.org/10.1016/j.eururo.2013.04.001>
7. Nitti VW, Dmochowski R, Herschorn S, et al. OnabotulinumtoxinA for the treatment of patients with overactive bladder and urinary incontinence: Results of a phase 3, randomized, placebo-controlled trial. *J Urol* 2013;189:2186-93. <https://doi.org/10.1016/j.juro.2012.12.022>
8. Cruz F, Herschorn S, Aliotta P, et al. Efficacy and safety of onabotulinumtoxinA in patients with urinary incontinence due to neurogenic detrusor overactivity: A randomized, double-blind, placebo-controlled trial. *Eur Urol* 2011;60:742-50. <https://doi.org/10.1016/j.eururo.2011.07.002>
9. Shaban AM and Drake MJ. Botulinum toxin treatment for overactive bladder: Risk of urinary retention. *Curr Urol Rep* 2008;9:445-51. <https://doi.org/10.1007/s11934-008-0077-1>
10. Denys P, Le Normand L, Ghout I, et al. Efficacy and safety of low doses of onabotulinumtoxinA for the treatment of refractory idiopathic overactive bladder: A multicenter, double-blind, randomized, placebo-controlled, dose-ranging study. *Eur Urol* 2012;61:520-9. <https://doi.org/10.1016/j.eururo.2011.10.028>
11. Schmid DM, Saueremann P, Werner M, et al. Experience with 100 cases treated with botulinum-A toxin injections in the detrusor muscle for idiopathic overactive bladder syndrome refractory to anticholinergics. *J Urol* 2006;176:177-85. [https://doi.org/10.1016/S0022-5347\(06\)00590-8](https://doi.org/10.1016/S0022-5347(06)00590-8)

12. Rovner E, Kennelly M, Schulte-Baukloh H, et al. Urodynamic results and clinical outcomes with intradetrusor injections of onabotulinumtoxinA in a randomized, placebo-controlled, dose-finding study in idiopathic overactive bladder. *Neurourol Urodyn* 2011;30:556-62. <https://doi.org/10.1002/nau.21021>
13. van Breda HMK and Heesakkers JFPA. Botulinum toxin A in clinical practice, the technical aspects, and what urologists want to know about it. *Urol Int* 2015;95:411-6. <https://doi.org/10.1159/000381881>
14. Eckhardt SE, Takashima Y, Handler SJ, et al. Antibiotic regimen and route of administration do not alter rates of urinary tract infection after intravesical botulinum toxin injection for overactive bladder. *Int Urogynecology J* 2021;33:703-9. <https://doi.org/10.1007/s00192-021-04691-4>
15. Lightner DJ, Wymer K, Sanchez J, et al. Best practice statement on urologic procedures and antimicrobial prophylaxis. *J Urol* 2020;203:351-6. <https://doi.org/10.1097/JU.0000000000000509>
16. Houman J, Moradzadeh A, Patel DN, et al. What is the ideal antibiotic prophylaxis for intravesically administered Botox injection? A comparison of two different regimens. *Int Urogynecology J* 2019;30:701-4. <https://doi.org/10.1007/s00192-018-3721-4>
17. Nicolle LE, Gupta K, Bradley SF, et al. Clinical practice guideline for the management of asymptomatic bacteriuria: 2019 update by the Infectious Diseases Society of America. *Clin Infect Dis Off Publ Infect Dis Soc Am* 2019;68:e83-110. <https://doi.org/10.1093/cid/ciy1121>
18. Aharony S, Przydacz M, Van Ba OL, et al. Does asymptomatic bacteriuria increase the risk of adverse events or modify the efficacy of intradetrusor onabotulinumtoxinA injections? *Neurourol Urodyn* 2020;39:203-10. <https://doi.org/10.1002/nau.24169>
19. Schurch B, de Sèze M, Denys P, et al. Botulinum toxin type a is a safe and effective treatment for neurogenic urinary incontinence: Results of a single treatment, randomized, placebo-controlled, 6-month study. *J Urol* 2005;174:196-200. <https://doi.org/10.1097/01.ju.0000162035.73977.1c>
20. Kuo HC. Comparison of effectiveness of detrusor, suburothelial, and bladder base injections of botulinum toxin a for idiopathic detrusor overactivity. *J Urol* 2007;178:1359-63. <https://doi.org/10.1016/j.juro.2007.05.136>
21. Karsenty G, Baverstock R, Carlson K, et al. Technical aspects of botulinum toxin type A injection in the bladder to treat urinary incontinence: Reviewing the procedure. *Int J Clin Pract* 2014;68:731-42. <https://doi.org/10.1111/ijcp.12360>
22. Nambiar AK, Younis A, Khan ZA, et al. Alkalinized lidocaine versus lidocaine gel as local anesthesia prior to intra-vesical botulinum toxin (BoNTA) injections: A prospective, single-center, randomized, double-blind, parallel-group trial of efficacy and morbidity. *Neurourol Urodyn* 2016;35:522-7. <https://doi.org/10.1002/nau.22750>
23. Mehnert U, Boy S, Schmid M, et al. A morphological evaluation of botulinum neurotoxin A injections into the detrusor muscle using magnetic resonance imaging. *World J Urol* 2009;27:397-403. <https://doi.org/10.1007/s00345-008-0362-0>
24. Karsenty G, Elzayat E, Delaparent T, et al. Botulinum toxin type a injections into the trigone to treat idiopathic overactive bladder do not induce vesicoureteral reflux. *J Urol* 2007;177:1011-4. <https://doi.org/10.1016/j.juro.2006.10.047>
25. Lucioni A, Rapp DE, Gong EM, et al. Intravesical botulinum type A toxin injection in patients with overactive bladder: Trigone vs. trigone-sparing injection. *Can J Urol* 2006;13:3291-5.
26. Doherty A, Hennessey DB, Onggo JR, et al. Modifications to botulinum toxin A delivery in the management of detrusor overactivity recalcitrant to initial injections: A review. *World J Urol* 2019;37:891-8. <https://doi.org/10.1007/s00345-018-2456-7>
27. Jiang YH, Jhang JF, Lee CL, et al. Comparative study of efficacy and safety between bladder body and trigonal intravesical onabotulinumtoxinA injection in the treatment of interstitial cystitis refractory to conventional treatment: A prospective, randomized, clinical trial. *Neurourol Urodyn* 2018;37:1467-73. <https://doi.org/10.1002/nau.23475>
28. Liao CH and Kuo HC: Practical aspects of botulinum toxin-A treatment in patients with overactive bladder syndrome. *Int Neurourol J* 2015;19:213-9. <https://doi.org/10.5213/inj.2015.19.4.213>

**Correspondence:** Dr. Humberto Vigil, Division of Urology, Department of Surgery, University of Ottawa, Ottawa, ON, Canada; [hvigil@toh.ca](mailto:hvigil@toh.ca)